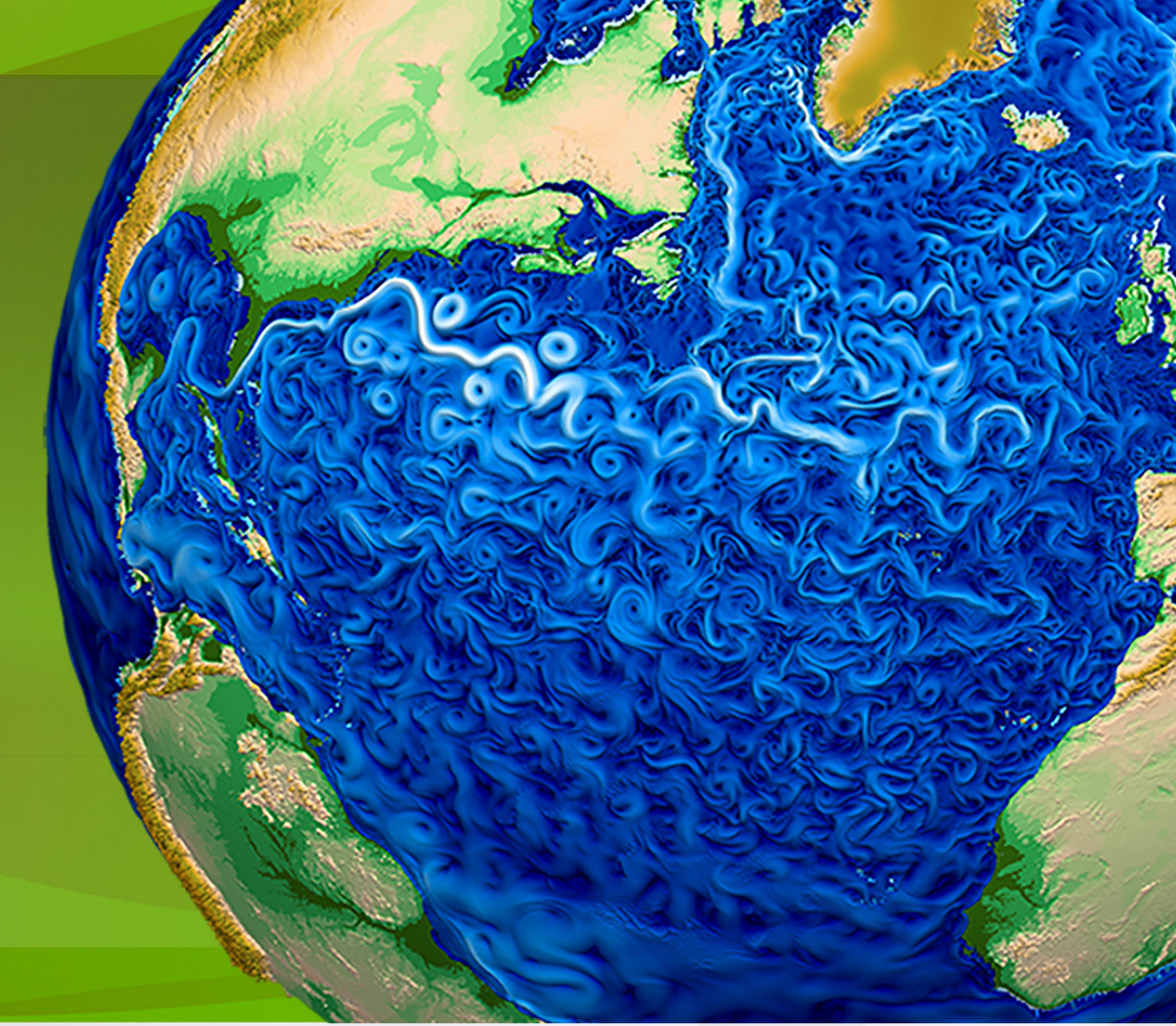


F: Single Column Modeling in ACME

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Motivation

Ability to run a single column independently from a GCM is useful for:

1. Computational efficiency: single column model (SCM) simulations are extremely cheap, which makes them useful for prototyping, parameter sensitivity studies, and testing
2. Understanding processes: simplifying the model makes it easier to understand the behavior of and interaction between processes.

EXAMPLES:

- The SCM has proven useful for identifying unphysical interaction between condensation and precipitation

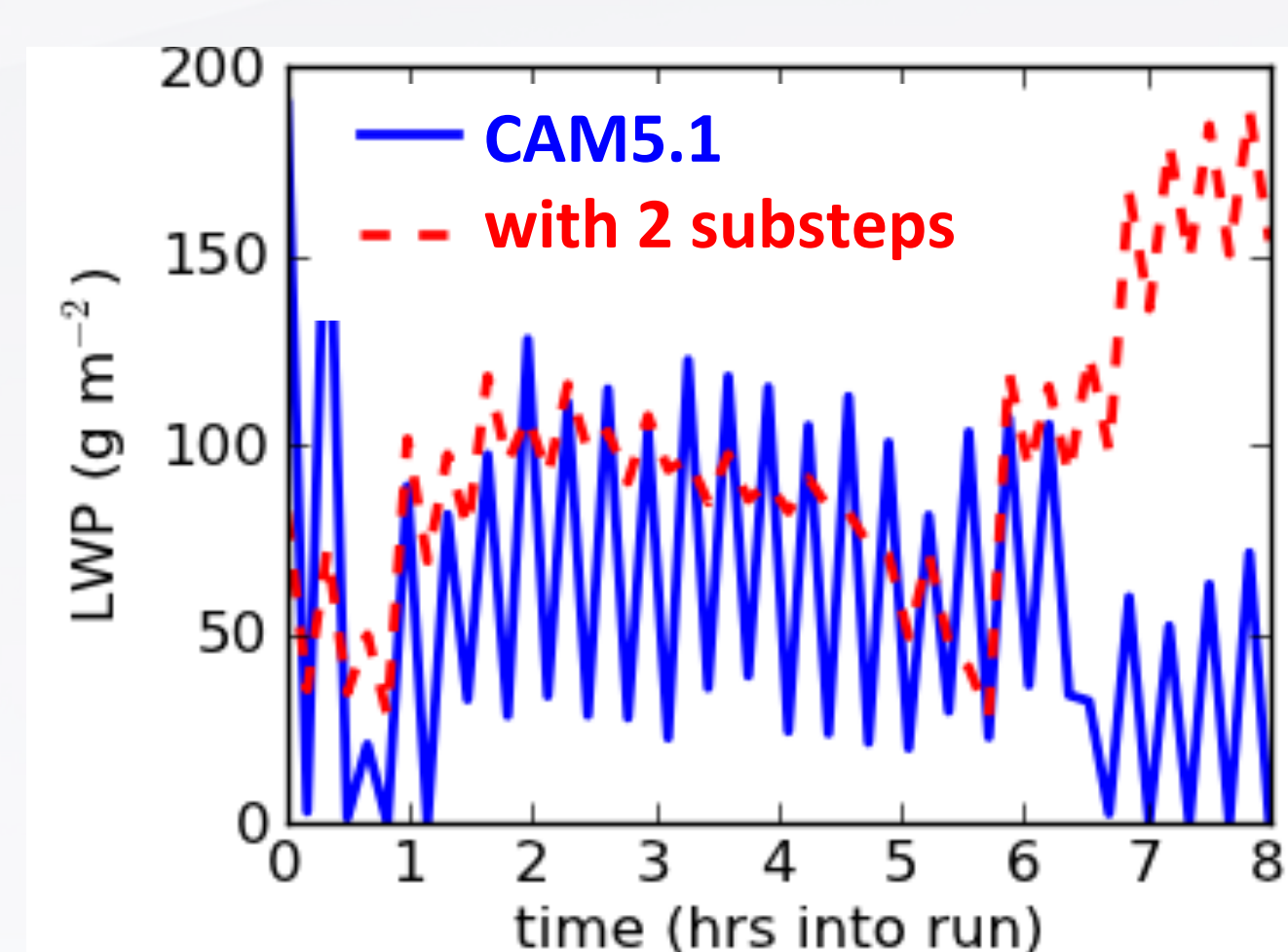


Fig 1: Liquid water path before & after microphysics from a single-column MPACE-B run.

- The SCM is being used for convection testing

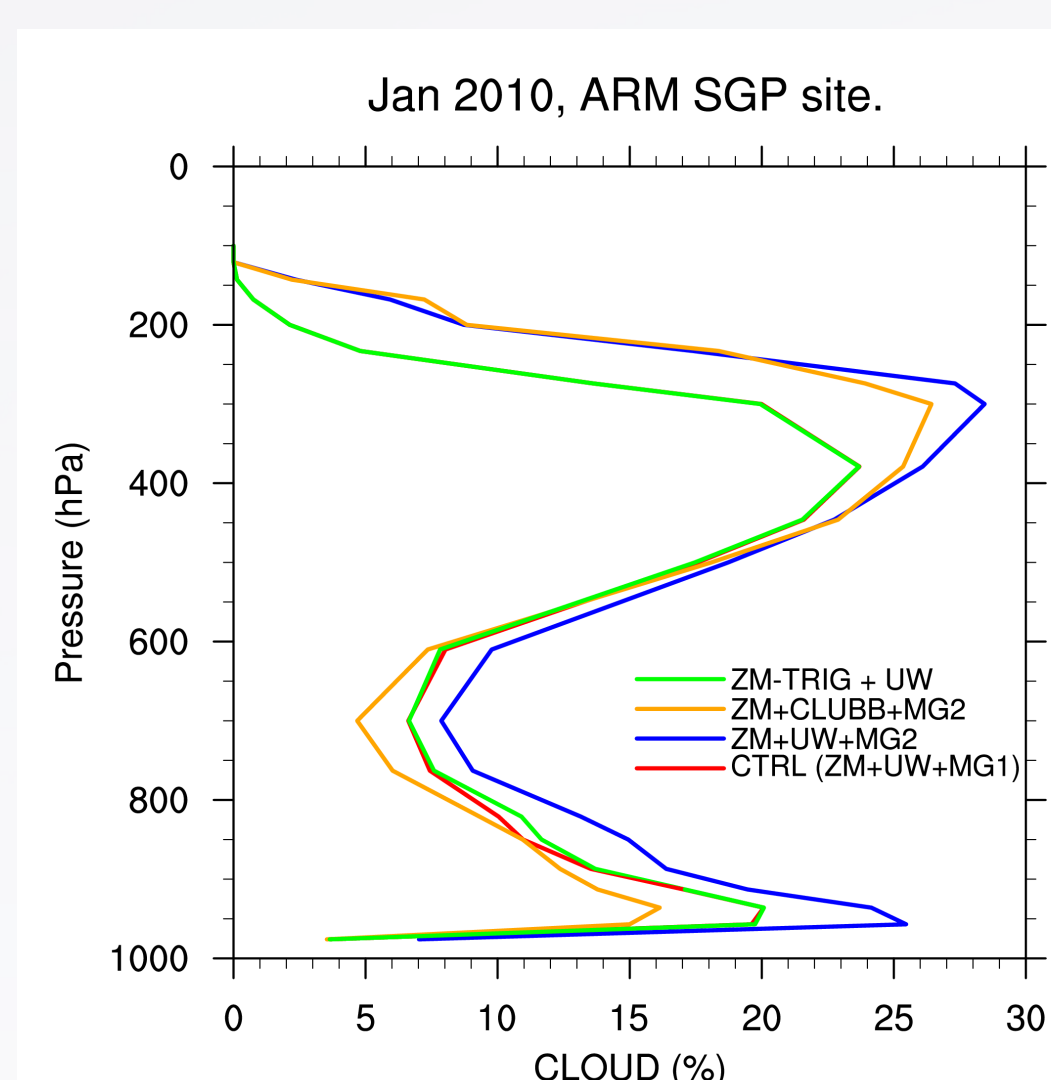


Fig 2: SCM runs using candidate convection schemes driven by observations for Jan 2010 at ARM SGP site.

- ARM97, TWP-ICE, MC3E, 2009-2010 long-term SGP, and model output cases are planned

see <https://acme-climate.atlassian.net/wiki/display/ATM/Evaluating+Convective+Parameterizations+Using+Single+Column+Simulations>

Near-Term (Q4-Q5) Plans

- We will collect canonical SCM cases spanning important climate regimes and make them available on the web (see Fig 3)
- Input, output, and validation datasets (stored on ESGF or ACME inputdata svn archive?) will be available for download on this webpage
 - Validation data will be the best available observational and/or LES data for that case
 - Output will be simulation output for a particular ACME tag. It will be useful for porting to new machines and/or checking code changes.
- Run scripts for each case will also be available. These scripts will include flags to trigger all appropriate idealizations for that case
 - Code for these idealizations will be added to ACME master
- The SCM will be used for nightly testing (Lead = Jeff Johnson):
 - "Victory conditions" will be established for each canonical case
 - These conditions will be tested by the ACME automated testing system in an SCM test suite/category.
- We will begin with cases we have been using and add more as time allows

ACME SCM Webpage

This is the place to find all input, output, scripts, and instructions for running ACME's single column model.

Choose a case from the list below, download the iop file and run script, and follow these directions to run it: [Configuring, building, and running the Single Column Model \(SCM\)](#). Then compare against model output or obs data. Details of experiment design (relevant papers, idealizations, limitations, etc) are provided in the notes for each case.

DYCOMS RF01	drizzling subtropical Sc	iop file	run script	output	obs data	notes
MPACE-B	mixed-phase Arctic Sc	iop file	run script	output	obs data	notes
BOMEX	non-raining tropical ShCu	iop file	run script	output	obs data	notes
RICO	precipitating tropical ShCu	iop file	run script	output	obs data	notes
ARM97	Midlat Continental DpCu	iop file	run script	output	obs data	notes
TWP-ICE	tropical oceanic DpCu	iop file	run script	output	obs data	notes
SPARTICUS	cirrus	iop file	run script	output	obs data	notes

<more cases will be added as they are created>

Fig 3: Mock-up of SCM website.

Long-Term Plans

- SCM will be made dycore-independent or will use the SE rather than Eulerian dycore
 - We will revisit the possibility of replacing the SCM with a coarse-resolution, specified-dynamics GCM as an easier-to-maintain but functionally equivalent alternative to SCM
- We will write code enabling ACME GCM runs to save all data needed to perform SCM simulations which exactly reproduce GCM behavior for a column of interest
 - This capability already exists ("camiop") but only for the Eulerian dycore. It also has problems with MPI and restarts
- We will develop a strategy for improving the relevance of SCM runs to GCM behavior
 - SCMs have a reputation for responding differently than GCMs to forcing (perhaps because constant forcing causes them to lock to certain grid levels). We will explore strategies (like stochastic forcing or higher vertical resolution) which solve this problem.

Opportunities for Interaction

- Our SCM code and cases will be available for everyone on ACME. We hope you will find it useful for your development and testing work!
- If you use other SCM case studies for your work, please let us know and we will add them to our archive.
- If you use SCM cases studies we use as well, check your version against ours to make sure our simulations are bug free!